



APPLICATION OF BIOPORE INFILTRATION HOLE INNOVATION FOR WATERLOGGING REDUCTION IN URBAN AREAS: A CASE STUDY OF PANJER VILLAGE

Oleh

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Abstract: *The community service activity which was carried out in the Panjer Traditional Village, Denpasar aims to help overcome flooding in the Panjer Traditional Village area by installing hundreds of biopore holes. Biopores are small holes made at the surface of the soil with the aim of increasing the soil's absorption of rainwater. This method was first developed by Dr. Kamir R. Brata from the Bogor Agricultural University (IPB) as a solution to overcome the problem of waterlogging and urban flooding. Biopore holes are made using special tools to drill the soil to a certain depth, usually filled with organic matter such as leaves or food scraps. This organic matter will then be broken down by soil microorganisms, creating empty spaces that increase soil porosity. The activity was carried out simultaneously with hundreds of students and lecturers of the Faculty of Engineering and Informatics, Universitas Pendidikan Nasional. There are 14 groups divided into this biopore hole installation activity. The installation locations are spread across several points starting from the Waturenggong Street area to the end of Jalan Tukad Yeh Aya. The main function of biopores is to increase the absorption of groundwater, so that it can help reduce the risk of flooding and waterlogging. In addition, biopores also function to improve soil structure and increase soil fertility by adding organic matter. Another benefit of biopores is that it helps the process of recycling organic waste into compost that is beneficial to plants.*

INTRODUCTION

Panjer Traditional Village is located in the city of Denpasar, Bali, is one of the villages rich in tradition and culture. This village is known for its strong traditional system with various cultural traditions of its people that are still preserved. Along with the times, Panjer Traditional Village faces various challenges, one of which is the problem of flooding that often occurs in the rainy season. This flood not only disrupts the daily activities of residents, but also negatively impacts the condition of the soil and the environment. To overcome this problem, effective and sustainable solutions are needed, one of which is the application of

biopore holes. Biopore holes are small holes made on the ground surface with the aim of increasing soil absorption of rainwater (Yanti, Suhesti, and Ratnaningsih, 2023). This biopore installation method was first developed by Dr. Kamir R. Brata from the Bogor Agricultural University (IPB) as a solution to overcome the problem of waterlogging and urban flooding (Jayasin, Ramelan et al., 2022). Biopore holes are made using special tools to drill the soil to a certain depth, usually filled with organic matter such as leaves or food scraps. This organic matter will then be broken down by soil microorganisms, creating empty spaces that increase soil porosity (Jati, Budi et al., 2023).

The use of biopore holes in the customary village environment has many advantages. First, biopore holes help increase groundwater absorption so that it can reduce the risk of flooding and waterlogging. Rainwater that should flow and cause flooding can be absorbed by the soil through biopore holes and replenish groundwater reserves. Second, biopore holes help improve soil structure and increase soil fertility by adding organic matter. Good soil is very important to support the fertility of roadside plants and farming activities of villagers to help shade the corners of the city. Third, biopore holes also function as better organic waste management. Organic waste that is put into the biopore hole will decompose into compost that is useful for plants.

One of the main functions of biopore holes is to overcome flooding. In Panjer Traditional Village, floods often occur during the rainy season due to inadequate drainage systems and soil conditions that are not able to absorb water properly. With biopore holes, rainwater can be absorbed more effectively by the soil, reducing the amount of water flowing on the surface and reducing the risk of flooding (Aflah, Radityo, and Pratiwi, 2023). In addition, biopore holes also help reduce soil erosion caused by the heavy flow of surface water. In addition to tackling flooding, biopore holes are also useful for soil fertilization. The organic matter that is put into the biopore hole will decompose and become compost, which is then absorbed by the soil. This process helps to increase the content of organic matter in the soil which is very important for soil fertility. Fertile soil has a better ability to support plant growth, which in turn can increase the amount of oxygen and shade of the environment around the Panjer Traditional Village.

The program for the implementation of biopore holes in Panjer Traditional Village is a cooperation and service program from the Universitas Pendidikan Nasional through grants given to support community service activities. This grant is used to purchase the equipment needed, such as biopore hole making tools, as well as other materials that will be used. In addition, this grant is also used for the installation of biopores directly in the village, as well as socialization to traditional bendes and banjar kelian on how to make and utilize biopore holes. This socialization is very important to ensure that villagers can independently implement and maintain biopore holes, so that the benefits can be felt in a sustainable manner. Through this grant program, the Universitas Pendidikan Nasional not only plays a role as an educational institution, but also as an agent of change that actively contributes to solving environmental problems in society. The program for the implementation of biopore holes in Panjer Traditional Village is expected to be an example for other villages in overcoming flood problems and increasing soil fertility. Thus, this program not only provides direct benefits to the residents of Panjer Traditional Village, but also has a wider positive impact on flood control efforts and sustainable environmental management. The implementation of biopore holes in Panjer Traditional Village is an effective and sustainable



step in overcoming flooding problems and increasing soil fertility. Through the support of the Universitas Pendidikan Nasional, this program is expected to run well and provide significant benefits for villagers, as well as create a better and sustainable environment for future generations.

The work program offered in the implementation of community service activities is more aimed at helping the community in the Panjer Traditional Village in flood management through the installation of biopore holes at several points around the village. There are 14 points determined for the installation of hundreds of biopore holes, namely Banjar Tegal Sari, Banjar Maniksaga, Banjar Celuk, Banjar Antap, Banjar Kangin, Banjar Kaja, Banjar Sasih, Banjar Kerta Sari, Banjar Bekul, Desa Temple, Dalem Temple, Tegal Penangsar Temple, TPS3R, and the Panjer Village Office. In addition, this work program is aimed at supporting the fertilization of shady soil and trees around the Panjer Traditional Village which plays a role in cooling the village environment. Panjer Traditional Village faces significant flood challenges during the rainy season. To overcome this problem, the biopore hole application program has been designed to help flood control and soil fertilization in the Panjer area. The installation of biopore holes is an effective method in increasing groundwater absorption and improving soil structure through organic waste management. The program consists of several important steps that include the creation of biopore holes, installation in the ground, as well as the tools needed during installation.

Biopore holes are made using a special tool called a ground drill. The manufacturing process begins by choosing a suitable location, which is in an area prone to waterlogging or close to plants that need to increase soil fertility. Biopore holes are made with a diameter of about 10-30 cm and a length set to a depth of 100 cm then drilled into the ground (Suyatmini and Mahyuni, 2022). After that, the hole is filled with organic matter such as leaves, food scraps, or compost. This organic matter will be decomposed by soil microorganisms, creating empty spaces that increase soil porosity and water absorption (Risna, Azizah et al., 2022). The steps for installing biopore holes involve several stages. According to Sinulingga et al. (2024), the first step taken is to select the installation location based on the analysis of areas that often experience waterlogging or erosion. Once the location is determined, a ground drill tool is used to make a hole with a predetermined depth and diameter. The hole is then filled with organic matter until it is full. Hole covers can be used to maintain cleanliness and prevent the entry of foreign objects. In addition, routine maintenance is carried out by adding organic matter periodically to ensure the function of the biopore hole remains optimal.

Some of the main tools needed during biopore hole installation include soil drills (manual or automatic), hoes, shovels, and organic materials such as dry leaves, food scraps, or compost (Fajri, Lestari et al., 2023). A ground drill is an important tool used to make holes of the right size and depth. Hoes and shovels are used to clean the area around the hole and help in the filling of organic matter. In addition, hole covers are also prepared to maintain the cleanliness and efficiency of biopore holes. Banjar Kaja Panjer was chosen as the location for the installation of biopore holes because this area often experiences flooding and has soil that needs increased fertility. Biopore holes will be installed at several strategic points that have been identified through surveys and field analysis. These locations include areas around residential areas, crops, and areas that are often flooded. With the installation in these locations, it is hoped that groundwater absorption will increase and the risk of flooding can be significantly reduced.

Biopore holes have many benefits that can be felt by the residents of Panjer Traditional Village. First, biopore holes help increase groundwater absorption, thereby reducing the risk of flooding and waterlogging in the rainy season. Second, biopore holes help improve soil structure and increase soil fertility by adding organic matter. Third, biopore holes serve as better management of organic waste, reducing the amount of waste thrown away and turning it into compost that is useful for plants. Fourth, biopore holes help reduce soil erosion by increasing the porosity and ability of the soil to absorb water. Through this program, it is hoped that Panjer Traditional Village can reduce the risk of flooding, increase soil fertility, and better manage organic waste. Biopore holes not only help create a cleaner and healthier environment, but can also maintain the sustainability of quality of life. With the support of the Universitas Pendidikan Nasional and the cooperation of all villagers, this program is expected to run well and provide significant benefits for all parties involved.

METHOD

Community service activities in Panjer Traditional Village are designed to help overcome flooding naturally and increase public awareness of the various benefits of biopore holes. This program was carried out as a form of initiative of the Mechanical Engineering Student Association, Universitas Pendidikan Nasional for the community in the Panjer environment. The methodology carried out in the implementation of the activity includes socializing and observing the surrounding environment, making biopore holes, and installing them in the Panjer environment.

A. Socialization and Observation of the Surrounding Environment

The implementation of community service begins with observation of the surrounding environment to obtain an overview of points that are prone to waterlogging. This activity focuses on the objectives of the program, as well as collecting information to determine the number of biopore holes that will be produced and installed later. The activity was carried out through good cooperation with the Village Head of the Panjer Traditional Village. Observations were carried out from the area of Jalan Waturenggong Denpasar to the end of Jalan Tukad Yeh Aya which is a densely populated location, as well as minimal water drainage. Documentation of activities can be seen in Figure 1 and Figure 2.



Figure 1. Banner of Socialization Activities



Figure 2. Socialization with Students and the Panjer Community

B. Biopore Hole Making

Making biopore holes is one of the easy and simple steps. The materials needed include pvc pipes, pipe covers, and drills. The pipe is cut with a length of 100 cm and a diameter of approximately 10 cm. Then perforate the pipe and pipe cover with a drill as a way to infiltrate water. The number of biopore holes produced is as many as 100 pieces that will be installed at 14 points around the Panjer Traditional Village. Documentation of the activity can be seen in Figure 3.



Figure 3. Biopore Hole Production Results

C. Installation in the Panjer Environment

After making biopore holes, the next step is to install at several location points. There are 14 points where the biopore hole is installed. One of the location points is in Banjar Kaja Panjer which obtained 10 biopore holes. The number of students involved in this installation is 8 people from the Management, Information Technology, and Civil Engineering study programs. Documentation of the installation of biopore holes can be seen in Figure 4 and Figure 5.



Figure 4. Biopore Installation Process



Figure 5. Installation Results

RESULT

This community service activity in Panjer Traditional Village, Denpasar succeeded in helping flood management and increasing public awareness of the importance of installing biopore holes in the surrounding environment. Before the community service program was carried out, many people complained about the high water during the rainy season, as well as the appearance of many waterlogging points that are prone to becoming mosquito breeding sites. However, after the program was implemented, there happened to be very heavy rain which was also proof of the effectiveness of this biopore hole. Water that was initially less can be absorbed into the soil, now the absorption process has become better. The number of waterlogging has also decreased. However, it needs to be admitted that the installation of biopore holes requires a larger number because of the size of this Panjer area.

The results of this community service activity consist of 2 things, namely in the realm of education in the form of socialization to the people of Panjer Traditional Village and students of the Universitas Pendidikan Nasional about the importance of using biopore holes. The increase in knowledge about the use of biopore holes has an impact on reducing waterlogging points, the potential for flooding, and the soil will become more fertile. In addition, reducing the amount of standing water will help reduce the development of dengue fever mosquito larvae. Dengue fever mosquitoes begin their development by looking for puddles, then give birth to larvae that will then become mosquito larvae. These larvae will grow into mosquitoes that are very dangerous to the surrounding community. Through this activity, it can indirectly support reducing the number of dengue fever cases that are currently rampant in



the Panjer community. Moreover, the Panjer area is one of the densely populated areas in Denpasar.

DISCUSSION

Many positive things have been achieved in this community service activity. The first is to increase public understanding and awareness of the importance of using biopore holes, help reduce the number of waterlogging and floods, help increase the amount of municipal groundwater, reduce the potential for dengue mosquito growth, and become the foundation for the success of cooperation between the Universitas Pendidikan Nasional institution and the Panjer Village Village Village Customary Village. The participation and activeness of the community to participate in the success of this activity is also one of the indicators of the success of this community service program.

CONCLUSION

The application of biopore holes in community service activities in Panjer Traditional Village is an effective and sustainable step in overcoming flood problems and increasing soil fertility. Biopore holes, which are small holes in the soil filled with organic matter, help increase groundwater absorption and reduce the risk of flooding. The process of installing biopore holes involves making holes using a soil drill and filling the holes with organic matter such as dried leaves or food scraps. The main tools needed during installation include soil drills, hoes, shovels, and organic matter. The installation location in Banjar Kaja Panjer was selected based on the analysis of areas that are prone to waterlogging and require increased soil fertility. The benefits of biopore holes include increased groundwater absorption, improved soil structure, better organic waste management, and reduced soil erosion. The program is supported by a grant from the Universitas Pendidikan Nasional which is used to purchase equipment and hold socialization to villagers. Thus, biopore holes not only help create a cleaner and healthier environment, but also support soil fertility and people's quality of life. Through cooperation between the university and the community, it is hoped that this program can run well and provide significant benefits for the Panjer Traditional Village.

Suggestions that can be given for the sustainability of the biopore pit implementation program in Panjer Traditional Village are the importance of continuous commitment and cooperation between various parties, including the village government, local communities, and educational institutions such as the Universitas Pendidikan Nasional. To increase the effectiveness and impact of this program, it is necessary to periodically monitor and evaluate the condition of biopore holes and the benefits obtained. The village government can set up a special team responsible for monitoring and maintaining biopores, as well as conducting additional training for residents who do not fully understand how to make and maintain biopores. In addition, it is important to continue to educate the public about the importance of biopore holes and their impact on the environment, so that awareness and active participation from residents can continue to be increased. Through consistent socialization and environmental campaigns, it is hoped that more citizens will be motivated to apply this method in their respective neighborhoods. The Universitas Pendidikan Nasional can also continue to provide support in the form of technical and academic assistance, as well as involve students in community service activities to provide a real and useful learning experience. This program can also be expanded by involving schools around Panjer

Traditional Village to integrate the concept of biopore holes in the environmental education curriculum. Thus, the younger generation can better understand and appreciate the importance of maintaining ecosystem balance. In addition, local governments can provide incentives or awards for residents who actively participate in this program, so that they can encourage motivation and the spirit of mutual cooperation in protecting the environment. Overall, good collaboration between the government, the community, and educational institutions will ensure that the biopore pit implementation program runs successfully and provides long-term benefits to the Panjer Traditional Village and its surroundings

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